KamLAND – Kamioka Liquid-scintillator Anti-Neutrino Detector

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KamLAND is an ambitious neutrino experiment being constructed in Mt. Ikenoyama in Central Japan, the site of the original Kamiokande and Super-Kamiokande experiments. Motivated by the persistent deficits observed in both the solar neutrino experiments and the recent Super-Kamiokande atmospheric neutrino results, KamLAND proposes to 1) investigate most of the neutrino oscillation solutions covered by solar neutrino and atmospheric neutrino experiments and 2) for the first time bridging region between these solutions and the existing reactor and accelerator probed parameter space. See Figure 1. KamLAND will initially focus on the reactor neutrino signals provided by power reactors that ring the Japan. The long baseline between these reactors and the KamLAND site and the energy spectrum of fission neutrinos permits the experiment to extend the search for neutrino oscillation signatures two orders of magnitude beyond existing experiments, fully encompassing the Large Mixing Angle solution proposed by the existing solar neutrino experiments. The coincident signal afforded by reactor anti-neutrinos ($\bar{\nu}_e + p \Rightarrow n + \beta^+$) assists in the identification of neutrino events.

The experiment will ultimately be extended to detector solar neutrinos (^{7}Be neutrinos) with subsequent detector upgrades.

KamLAND will employ one kiloton of liquid scintillator contained within a 6.5m radius transparent balloon. The experiment will be viewed by ~2000 20" and 17" PMTs contained on a 9m radius stainless steel spherical tank. In the reactor phase the experiment will detect approximately 750 $\bar{\nu}_e$ events per year from the reactors between 140 and 200 km away.

The experiment was previously funded in Japan and the construction of the detector well advanced. The US KamLAND proposal has been reviewed by the Department of Energy[1] and has been approved for funding in FY2000.

LBNL will provide calibration systems, front-end electronics, and systems engineering and project management functions for the US Collaboration.

Footnotes and References

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1. Proposal for US Participation in KamLAND, J. Busenitz *et al.* March 1999.

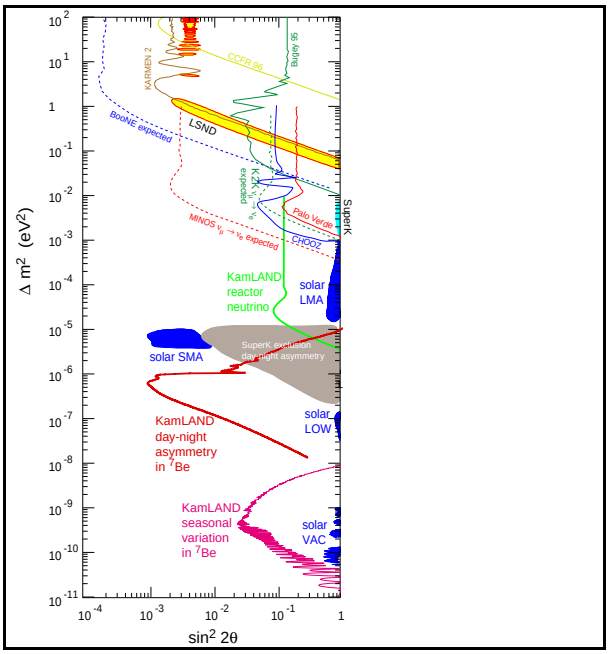

Fig. 1. Allowed and excluded regions in ΔM^2 – $\sin^2 2\Theta$ plane for ν_e oscillations. The existing limits are compared with current and future experiments and the region obtained by interpreting the solar neutrino anomaly as due to oscillations. The KamLAND reactor and solar neutrino experiments are shown.